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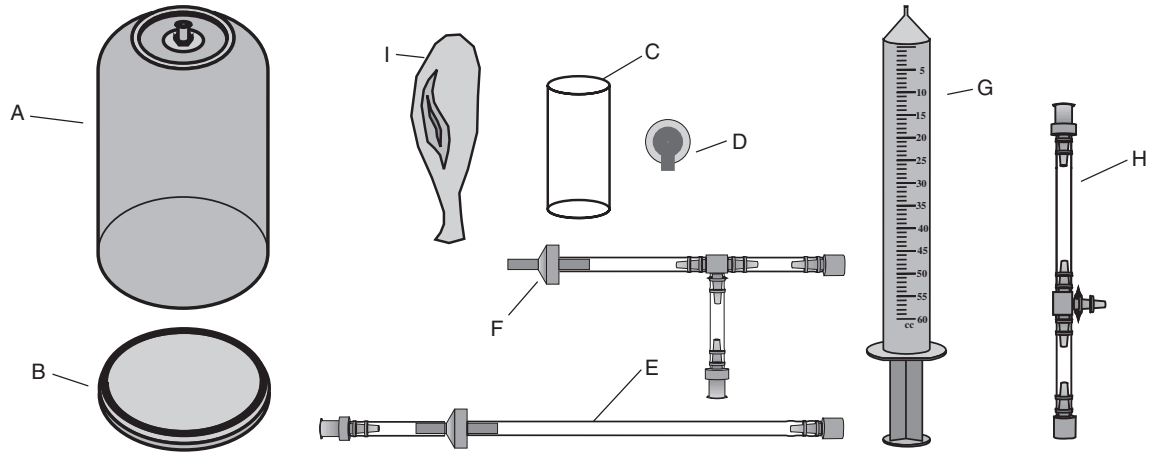
Instruction Sheet for the PASCO Model SE-9790

STUDENT BELL JAR



Introduction

The PASCO SE-9790 Student Bell Jar demonstrates the effect of air pressure on the boiling point of a liquid, on the size of a balloon, on the size of a marshmallow, and on the holding power of a suction cup. It also demonstrates that air has mass.

The syringe and one-way check valve system constitute an inexpensive vacuum pump.

An extra connector is provided to permit the Student Bell Jar to be connected to a PASCO Pressure Sensor (Absolute, CI-6532 or Differential, CI-6533), allowing the monitoring of the pressure inside the chamber.

Equipment

INCLUDED

Part Label	Part Name
A	bell jar top with connector
B	bell jar bottom with O ring
C	plastic cup
D	suction cup
E	tubing with check valve
F	tubing with T and check valve
G	60 cc syringe
H	tubing for connection with a PASCO Pressure Sensor
I	balloon

Note: Parts E, F, and G constitute the vacuum pump

ADDITIONAL SUGGESTED

- *ScienceWorkshop* Interface (300, 500, 700, or 750)
- computer and data acquisition software (*ScienceWorkshop* or DataStudio)

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Basic Setup and Operation

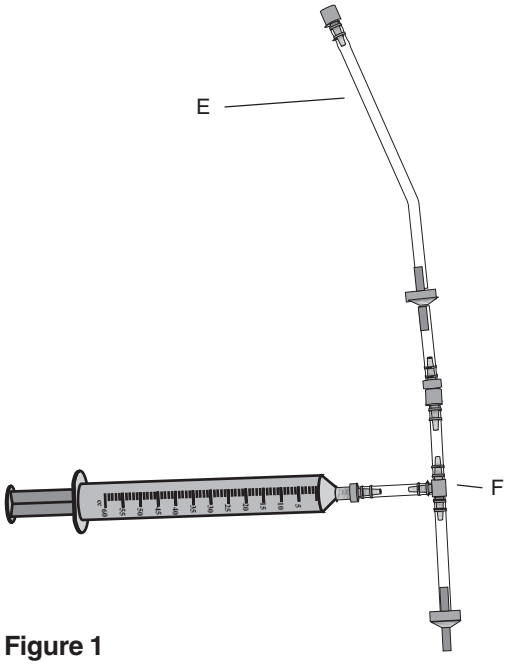

Figure 1
Assembling the vacuum pump

1. Assemble the vacuum pump as shown in Figure 1.
2. Attach part E to the connector on the top of the bell jar. Twist to secure the connection (Figure 2).

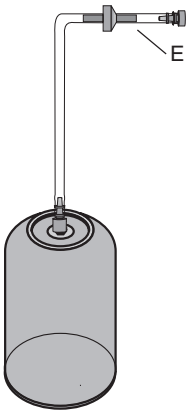

Figure 2
Attaching the vacuum pump to the bell jar

3. Do one of the following:
   - Place the balloon on the base of the bell jar.
   - Place a large, fresh marshmallow on the base of the bell jar.
   - Press the suction cup onto the base of the bell jar.
   - Half-fill the plastic cup with very hot coffee, and place it on the base of the bell jar (Figure 3).
4. Put the lid on the bell jar, hold it there firmly, and pump the piston of the syringe 10 to 15 times.

   Result:

   - the balloon will expand
   - the marshmallow will expand
   - the suction cup will fall off
   - the coffee will boil

   Suggestion: For the coffee boiling experiment, measure the coffee temperature before and after it boils.

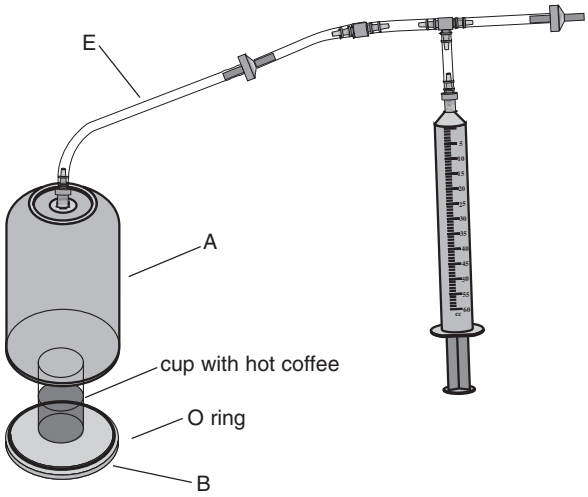

Figure 3
Completed setup for the coffee boiling demonstration

To Determine the Weight of Air

1. Find and record the original combined mass of parts A, B, and E.
2. Evacuate the chamber and disconnect A from E.
3. Find and record the resulting combined mass of parts A, B, and E .
4. Subtract the resulting combined mass from the original combined mass to find the mass of air in the bell jar.

Setup to Monitor the Interior Air Pressure

1. Connect part H to the hose connector on part A (Figure 4).
2. Connect part E to part H.
3. Connect part F to part E.
4. Connect the syringe to the T of part F.
5. Connect the Absolute Pressure Sensor to the T on part H.

   Plug the Pressure Sensor into analog channel A on your *ScienceWorkshop* computer interface.

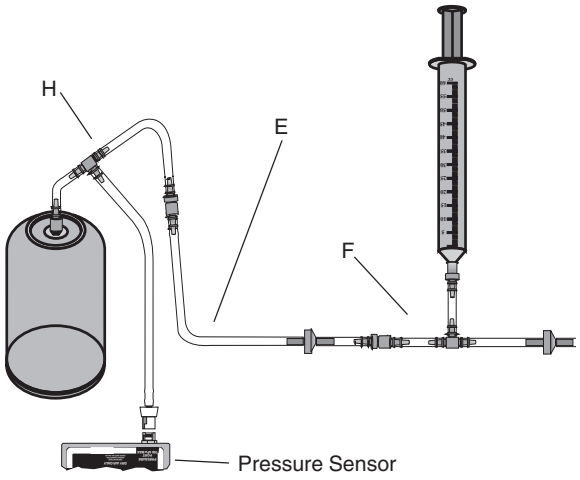

Figure 4
Setup with the Pressure Sensor and a *ScienceWorkshop* computer interface

Monitoring the Interior Air Pressure

After you have completed the setup that has just been described, set the Pressure Sensor up in your data acquisition software (*ScienceWorkshop* or DataStudio), and open a Graph display. When you are ready to start pulling the vacuum, start collecting data.

Maintenance

Bell Jar and O ring

The bell jar and O rings should be kept clean—free of dust.

- Use mild dishwashing soap and water to clean.

Cautions:

- Do not use abrasives.
- Do not use organic chemicals.

Note: Vacuum grease should not be necessary on the o-rings or connectors, and use of it will attract dust and dirt.

Syringe

- Glycerin may be used on the plunger, but normally, no lubricant is required.

Caution:

- Do not use any petroleum-based lubricant on the syringe. The plunger is very intolerant to petroleum-based substances.

Safety Considerations

This set is intended to be used by teachers, and their students while working under appropriate supervision.

Generally...
Please teach and expect safe behavior in your classroom and lab. Safety considerations call for supervision of students at all times, use of safety eyeware, no horseplay, no unauthorized experimentation, immediate reporting to the instructor of accidents or breakage, among others.

More Specifically...
Any liquids entering the pump are apt to be discharged as a mist or spray. Only safe liquids such as water should be allowed to be used in association with the pump, and safety eyeware is definitely required.

The bell jar should be used only with the bottom plate furnished. Attempting to evacuate the chamber while in contact with other surfaces could cause damage. Severe injury will result from evacuating the chamber while in contact with skin.

Do not put items in the bell jar that would be damaged by, or cause damage as a result of, reduced pressure. Examples would include sealed containers, wrist watches, batteries, etc. Certainly animals should not be placed in the bell jar, for reasons of law and human decency.

Do not use the apparatus if the bell jar or bottom plate have become cracked or otherwise damaged.

The exclamation point within an equilateral triangle is intended to alert the user of important operating and safety instructions that will help prevent damage to the equipment or injury to the user.

Limited Warranty

PASCO scientific warrants the product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. PASCO will repair or replace, at its option, any part of the product which is deemed to be defective in material or workmanship. The warranty does not cover damage to the product caused by abuse or improper use. Determination of whether a product failure is the result of a manufacturing defect or improper use by the customer shall be made solely by PASCO scientific. Responsibility for the return of equipment for warranty repair belongs to the customer. Equipment must be properly packed to prevent damage and shipped postage or freight prepaid. (Damage caused by improper packing of the equipment for return shipment will not be covered by the warranty.) Shipping costs for returning the equipment after repair will be paid by PASCO scientific.

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Note: This instruction sheet was written assuming that the user is familiar with *ScienceWorkshop* or DataStudio. Users can gain familiarity by working through the tutorials provided with *ScienceWorkshop* or from DataStudio's Online Help.